

PTO 08-1114

CC=JP  
DATE=19960123  
KIND=A1  
PN=08022922

LOADED TAB SWITCH AND ITS ABNORMAL DIAGNOSTIC DEVICE AND ITS  
ABNORMAL DIAGNOSTIC METHOD  
[FUKA JI TABBU KIRI KAERU SOCHI OYABI SONO IJO SHINDAN SOCHI  
NARABI NI SONO IJO SHINDAN HOHO]

YOSHIYUKI SENNO ET AL

UNITED STATES PATENT AND TRADEMARK OFFICE  
WASHINGTON, D.C. DECEMBER 2007  
TRANSLATED BY SCHREIBER TRANSLATIONS INC.

PUBLICATION COUNTRY (10): JA

DOCUMENT NUMBER (11): 0822922

DOCUMENT KIND (12): A

PUBLICATION DATE (43): 19960123

APPLICATION NUMBER (21): 6157144

APPLICATION DATE (22): 19940708

INTERNATIONAL CLASSIFICATION (51): H 01 F 29/04 ; //G 01R  
31/00

PRIORITY COUNTRY (33):

PRIORITY NUMBER (31):

PRIORITY DATE (32):

INVENTOR(S) (72):

APPLICANT(S) (71): HITACHI MANUFACTURING  
PLANT

DESIGNATED CONTRACTING STATES (81):

TITLE (54): LOADED TAB SWITCH AND  
ITS ABNORMAL  
DIAGNOSTIC DEVICE AND  
ITS ABNORMAL  
DIAGNOSTIC METHOD

FOREIGN TITLE [54A]: FUKA JI TABBU KIRI  
KAERU SOCHI OYABI SONO  
IJO SHINDAN SOCHI  
NARABI NI SONO IJO  
SHINDAN HOHO

/1<sup>1</sup>

[Title of Invention] Loaded tab switch and its abnormal diagnostic device and its abnormal diagnostic method

/2

[Scope of Patent Claims]

[Claim 1] In a loaded tab switch provided with a switch inside the transformer tank and a tab selector for tab selection of the transformer tab coil, this selector is placed adjacent to the lower part of the said switch, this loaded tab switch is provided with an insulated container filled with insulation oil inside, storing the thyristor switch placed in the aforementioned transformer tank in the oil; a gas analysis device for analyzing the gas mixture of the insulation oil inside this insulation container and an abnormal activity evaluation device for evaluating the abnormality based on this analysis result.

[Claim 2] In the loaded tab switch provided with a switch inside the transformer tank and a tab selector for tab selection of the transformer tab coil, this selector is placed adjacent to the lower part of the said switch, this loaded tab switch device is characterized in that the said thyristor switch and the aforementioned tab selector are stored inside the insulated container filled with the

---

<sup>1</sup> the numbers in the margin indicate pagination in foreign text

insulation oil and the thyristor switch is used in the aforementioned switch. Also, the insulation oil inside the insulated container and the gas mixed into the insulation oil are analyzed by the gas analyzer. Also, the abnormality of the switch and the tab selector are diagnosed by the abnormal activity evaluator based on this analysis result.

[Claim 3] The aforementioned insulated container of the loaded tab switch of Claim 1 or Claim 2

is provided with an upper cover for the transformer.

[Claim 4] The aforementioned insulated container of the loaded tab switch of Claim 1 or Claim 2

is formed dividing the switch and the tab selector from the upper side of the transformer.

[Claim 5] In the abnormal diagnostic device for this loaded tab switch provided with a switch inside the transformer tank and a tab selector for tab selection of the transformer tab coil, this selector is placed adjacent to the lower part of the said switch, the abnormal diagnostic device for this loaded tab switch is provided with a insulated container filled with insulation oil inside and thyristor switch is placed in the aforementioned transformer tank in the oil; a gas analysis device for analyzing the gas mixture of the insulation oil inside this insulation container and an abnormal activity evaluation

device for evaluating the abnormality based on this analysis result.

[Claim 6] In the abnormal diagnostic method of this loaded tab switch provided with a switch placed inside the transformer tank and a tab selector for tab selection of the transformer tab coil, this selector is placed adjacent to the lower part of the said switch, the abnormal diagnostic method of this loaded tab switch is characterized as being provided with an insulated container filled with insulation oil inside and storing the thyristor switch placed in the aforementioned transformer tank in the oil; a gas analysis device for analyzing the gas mixture of the insulation oil inside this insulation container and an abnormal evaluation device for evaluating the abnormality based on this analysis result. The aforementioned gas analyzer and abnormal activity evaluation device are activated during the operation of the loaded tab switch.

[Claim 7] In the abnormal diagnostic method of this loaded tab switch provided with a switch placed inside the transformer tank and a tab selector for tab selection of the transformer tab coil, this selector is placed adjacent to the lower part of the said switch, the abnormal diagnostic method of this loaded tab switch is characterized as being provided with an insulated container

filled with insulation oil inside and storing the thyristor switch placed in the aforementioned transformer tank in the oil; a gas analysis device for analyzing the gas mixture of the insulation oil inside this insulation container and an abnormal evaluation device for evaluating the abnormality based on this analysis result. The aforementioned gas analyzer and abnormal activity evaluation device are activated at a set distance during the operation of the loaded tab switch.

[Detailed explanation of the invention]

[0001]

[Industrial field of use] The invention pertains to the improvement of the loaded tab switch. In particular, it pertains to the improvement of the loaded tab switch by providing a special switch and the aforementioned tab selector is immersed in the insulation oil.

[0002]

[Prior Art] The loaded tab switch is provided with the switch and the tab selector. Thus, the operation of the transformer is not stopped by switching the tab. The flowing phase and voltage can be controlled. Recently, the need is to improve this operation and the reliability.

[0003] This type of loaded tab switch device that is generally used is as shown in figure 6 as symbol 25. It is

mounted at the lower end inside the transformer tank from the upper cover of the transformer tank 1. It is formed immersed in the insulation oil. The switching of the current is performed in the part at the switch 2. A mechanical drive part and a current switching contact point are provided in this part.

[0004] The switch is immersed in this insulation oil but this is soiled by the contact point arc of the switch, thus, generally, this insulation oil is conducted to the outside of the transformer, this is soiled by the active wire cleaning oil machine 8. Also, this switch 2 is enclosed in an insulated tube, the dirty oil is formed in a separate chamber and is not mixed with the oil in the transformer main chamber. The oil from the transformer main chamber is not poured out, it is taken out from the upper part.

[0005] On the other hand, the tab selector 3 that switches the coil tab in the transformer is placed directly inside the transformer tank. That is, it is placed inside the insulation oil of the transformer main chamber. Thus, the tab selection of the tab coil is performed by the movable contact piece 4 to connect to the tab lead wire 6 via the permanent contact piece 5.

[0006] For the normal loaded tab switch device formed in this way, recently, the loaded tab switch device uses a thyristor in the switch 2, this part is used.

/3

[0007] Figure 5 shows the circuit of the loaded tab switch device using that thyristor. TH1, TH2, TH3, TH4 are the thyristors. TS1, TS2 are the tab selectors, TW shows the transformer wire. The loaded tab switch device using the thyristor formed in this way does not interrupt the current at the contact point inside the oil so the oil is not deteriorated by the arc during the tab switching. A device is not required in the oil for cleaning the oil. Furthermore, the Patent Publication 42-21770 pertains to this.

[0008]

[The problems resolved by the invention] For the mechanical type of switch in the aforementioned conventional technology, the switch is inside insulation oil, since the decomposed gas is contained by the arc, the abnormality of the switch can be detected by performing the analysis for the gas inside the insulation oil. However, if the thyristor switch is used in the switch, the oil is not soiled by the arc, the decomposed gas mixed in the insulation oil is analyzed. That abnormality of the switch

is detected from the analysis result but in the conventional loaded tab switching device, the abnormality of the switch can be detected but the tab selector requires another part for the loaded tab switch, it is difficult to differentiate the abnormality in the transformer or the abnormality in the loaded tab switch device from the insulation oil in the transformer.

[0009] The purpose of the invention is to focus on this and offer a type of loaded tab switching device that can differentiate and detect sufficiently whether the loaded tab switching device is at an abnormal position.

[0010]

[Means for resolving the problems] That is, for the invention to achieve the aforementioned purpose, the tab selector and the thyristor switch are stored in the insulated container filled with the insulation oil and the thyristor switch is used in the switch device. The abnormality of the loaded tab switching device is diagnosed by the abnormal evaluation device based on the analysis result after analyzing by the gas analysis device.

[0011]

[Action] That is, if the loaded tab switching device is formed this way, the switch and the tab selector are stored in the insulated container. Since it is separated from the

transformer oil, the gas analysis in the tab switching can be performed, the abnormality of the loaded tab switching device can be differentiated and detected effectively, the diagnosis can be performed well.

[0012]

[Implementation example] The invention is explained in detail based on the implementation example shown below. The cross section of the loaded tab switching device and its surrounding area are shown in figure 1. Furthermore, the parts that are similar to the conventional parts used the same symbols so the explanation for these parts is omitted.

[0013] The loaded tab switching device 20 is mounted below the upper cover 1a inside the transformer tank 1. The loaded tab switching device 20 is provided with the switch device 2 and the tab selector 3. Then, the switch device 2 and the tab selector 3 are stored inside the insulated container 7 filled with the insulation oil.

[0014] The insulation container 7 is provided with an upper cover of the transformer tank. It is formed so it can be break down with the tab selector and the switch device from the upper part of the transformer.

[0015] Also, the insulation oil inside the insulated container 7 is sampled via the conducting oil pipe 10 at the vicinity of the transformer tank, the diagnostic

machine 30 for diagnosing the abnormality from the gas analysis result is placed.

[0016] This diagnostic machine 30 is provided with a gas extraction device 12 for analyzing the gas mixed into the insulation oil and the evaluation device 30 for evaluating the abnormality in the gas detector 16, as shown in figure 2.

[0017] The analysis of the gas in the oil of the loaded tab switching device is performed by selecting the oil that exists in the aforementioned insulated container 7. First, the oil valve 9 provided in the oil conducting pipe 10 is opened, the oil is sent to the gas analysis device 11 via this oil conducting pipe 10. The oil is sent to the gas oil extractor 12 inside the gas analysis device. There is a gas permeation polymer film 13 in this extractor. The conducted oil is separated via this film and is collected in this volumetric pipe 15.

[0018] After a certain time has elapsed, a certain amount of saturated gas has remained in the volumetric pipe 15, next, the gas is activated by the vacuum pump 17 by operating the switch valve 14, the air is used as the medium. The gas that is collected in the volumetric pipe 19 is returned to the gas detector 16. Then, it is separated into the gas component becoming the analysis objective in

the gas separation column 18. Finally, it is detected by the gas sensor 19.

[0019] The gas in the oil is separated and detected and this detected result is evaluated whether the internal state is good according to the pattern classification chart of the Electric Cooperation Research Vol 36 No. 1. For example, when the maximum concentration of H<sub>2</sub> is 1, the other component ratio is shown in figure 4, for the pattern shown, (1) is the short arc between the contact points, (2) the arc at the narrow conducting part.

[0020] For the loaded tab switching device shown above, the switch device 2 and the tab selector 3 are stored in the insulation container 7, it is separated from the transformer oil so the gas analysis in the tab switching is performed by the diagnostic device 30, the abnormality of the loaded tab switching device can be sufficiently differentiated from the abnormality of the transformer.

/4

[0021] In addition, for the switch device 2 and the tab selector 3 with this constitution, the oil inside the transformer tank is not taken out, the movable contact 4 piece is separated from the fix contact piece 5 attached to the insulation container 7, the load during the point inspection operation can be reduced.

[0022] Also, another implementation example is shown in figure 3, in this case, since the detected oil is not the selected oil, the oil residual part 21 is provided at a part in the aforementioned gas analysis device 11. The oil according to the requirement is extracted from this oil residual part. Due to this gas analysis device, that is, during the operation of the loaded tab switch, since the gas analysis device 11 and the evaluation device 30a are set at a certain distance, the effect of the invention can be achieved, the oil selection can be made easily.

[0023]

[Effect of invention] According to the invention as described above, by storing the switch and the tab selector inside the insulated container and separated from the transformer oil, the gas analysis in the tab switch can be performed, the abnormality of the loaded tab switching device can be sufficiently differentiated from the abnormality of the transformer. A reliable loaded tab switch can be obtained.

[Brief description of the diagrams]

[Figure 1] This is a partial cross section showing an implementation example of the loaded tab switch of the invention.

[Figure 2] This is the diagram showing an implementation example of the gas analysis device in the invention.

[Figure 3] This is a partial cross section showing another implementation example of the loaded tab switch of the invention.

[Figure 4] This is the diagram showing 1 example of the gas pattern for the gas analysis result evaluation of the invention.

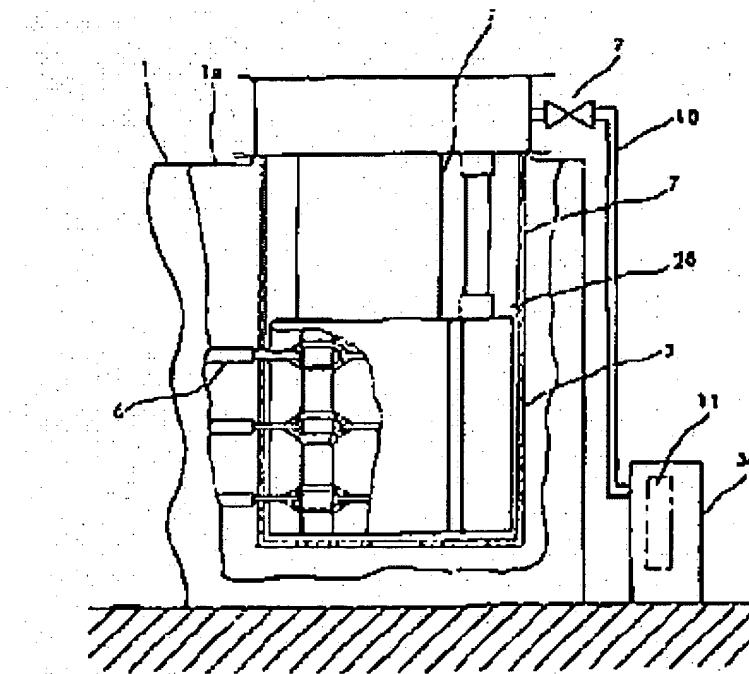
[Figure 5] This is the circuit of the loaded tab switch when the thyristor is used.

[Figure 6] This is a partial cross section of the conventional loaded tab switch.

[Description of the symbols]

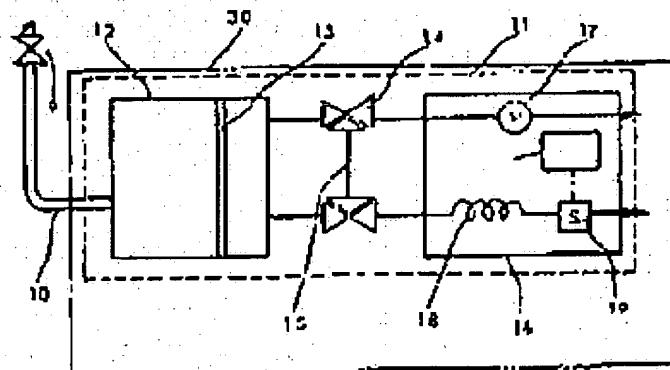
1 - transformer tank, 2 - switch, 3 - tab selector, 4 - movable contact piece, 5 - fix contact piece, 6 - tab lead, 7 - insulated container, 9 - oil valve, 10 - oil conducting pipe, 11 - gas analysis device, 12 - device for extracting gas from the oil, 13 - gas permeation film, 14 - switch valve, 15 - inspection pipe, 16 - gas detector, 17 - air pump, 18 - gas separation column, 19 - gas sensor, 30a - evaluation device.

[Figure 1]



1 - transformer tank, 2 - switch, 3 - tab selector, 4 - movable contact piece, 5 - fix contact piece, 6 - tab lead, 7 - insulated container, 9 - oil valve, 10 - oil conducting pipe, 11 - gas analysis device, 30 - evaluation device.

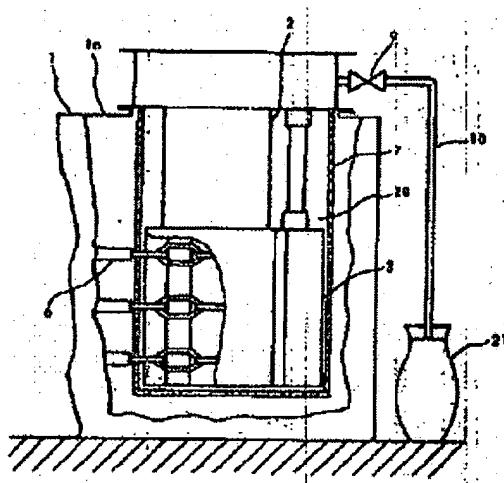
[Figure 2]



[Figure 4]

[Figure 5]

[Figure 3]



[Figure 6]

